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DEPARTMENT FOR ENVIRONMENTAL PROTECTION
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
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PRELIMINARY DETERMINATION AND STATEMENT OF BASIS ON THE APPLICATION OF

THOROUGHBRED GENERATING COMPANY, LLC
THOROUGHBRED GENERATING STATION

TO CONSTRUCT AND OPERATE A PULVERIZED COAL STEAM ELECTRIC GENERATING STATION

REVIEW AND ANALYSIS BY: Ben Markin

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1. EXECUTIVE SUMMARY

Thoroughbred Generating Company, LLC submitted a permit application dated February 28, 2001, to construct and operate a Pulverized Coal steam electric generating station in Muhlenberg County, Kentucky. The construction will consist of two 7443 MM BTU/hr Pulverized Coal Boilers (PCB) which will operate with a total nominal output capacity of 1500 megawatts (MW). Each PCB is to be equipped with its own exhaust stack located within a common chimney and will be equipped for fuel oil start-up. Other facilities to be constructed will include Flue Gas Desulfurization (FGD) reagent, ash, and solid waste by product storage and handling equipment; an auxiliary boiler; two cooling towers; oil storage tank; an emergency generator; and two diesel and one electric powered fire pumps. The plant is to be permitted to operate 8760 hours per year or less for each unit. The proposed plant will be a major source as defined in Kentucky State Regulation 401 KAR 51:017 (40 CFR 52.21), *Prevention of Significant Deterioration (PSD) of air quality*. The potential emissions of regulated air pollutants including particulate matter (PM & PM10), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO) and volatile organic compounds (VOC) are in excess of 250 tons per year. Additionally, the emissions of volatile organic compounds (VOCs), fluorides as HF, mercury (Hg), beryllium (Be), and Sulfuric Acid (H_2SO_4) mist are subjected to PSD review since these emissions exceed the significant emission rates as presented in Regulation 401 KAR 51:017, Section 22.

The proposed plant will belong to one of the 28 major source categories listed in the PSD regulation, 401 KAR 51:017, because the PCBs will be used as indirect heat exchangers to produce electricity. Additionally, the source will be located in a county classified as "attainment" or "unclassified" for each of these pollutants pursuant to Regulation 401 KAR 51:010, *Attainment Status Designations*. Consequently, the proposed facility meets the definition of a major stationary source and is subject to evaluation and review under the provisions of the PSD regulation for all these pollutants. A PSD review involves the following six requirements:

1. Demonstration of the application of Best Available Control Technology (BACT).
2. Demonstration of compliance with each applicable emission limitation under Title 401 KAR Chapters 50 to 65 and each applicable emissions standard and standard of performance under 40 CFR 60, 61, and 63.
3. Air quality impact analysis.
4. Class I area impact analysis.
5. Projected growth analysis.
6. Analysis of the effects on soils, vegetation and visibility.
7. A public commenting period, including an opportunity for a public hearing.

Furthermore, this source will also be subject to Title V and Title IV Phase II Acid Rain permitting. The Title V permitting procedures are contained in State Regulation 401 KAR 52:020, *Permits* and Federal Regulation, 40 CFR Part 70. The Title IV permitting procedures are within State Regulation 401 KAR 50:020, *Permits*, 401 KAR 52:060, *Acid Rain Permit*, and Federal Regulation 40 CFR part 76. This proposal represents the draft PSD/Title V permit and the draft Title IV Phase II Acid Rain permit. The preliminary determination is also provided as a statement of basis for the Title V permit. This review demonstrates that all regulatory requirements will be met and includes a draft permit that establishes the enforceability of all applicable requirements.

2. BACKGROUND

On March 01, 2001, the Division received a permit application to construct and operate pulverized coal fired boilers for electricity generation from Thoroughbred Generating Company, LLC. The application was logged complete on April 23, 2001. During the technical review process additional information was requested and responses received on the following dates:

Table 2.1 – Information Received from Applicant

Information Requested	Date Requested	Information Received	Date Received
PSD/Title V / Acid Rain Application		**Preliminary Application**	**March 01, 2001**
Response to FMLA Visibility impact	**May 24, 2001**	**TGS assessment of visibility impact**	**September 06, 2001**
Revised Modeling	**May 24, 2001**	**Revised Class 1 Visibility Impact**	**October 11, 2001**
Revised portions of Applications		**Complete Revised Application**	**October 26, 2001**

Information from the application is given and assumed.

3. EMISSIONS ANALYSIS

The proposed Thoroughbred Generating Station will produce electricity as an independent power producer. The electricity generation operations will consist of: two (2) pulverized coal-fired boilers PCBs (nominally 750 MWe each) equipped with selective catalytic reduction (SCR); baghouses; wet flue gas desulfurization (FGD); and a wet electrostatic precipitator (WESP). Additional processes at the facility will include a diesel fired auxiliary boiler (to operate 4000 hrs or less per year); two diesel and one electric emergency fire-water pumps (to operate 500 hours or less per year for testing and emergencies); an emergency diesel fired generator (to operate 500 hours or less per year for testing and emergencies); coal and FGD handling facilities; two cooling towers; coal storage piles; ash handling facilities; and two (2) fuel oil storage tanks. Detailed descriptions of the plant processes and expected emissions at each emissions point and emissions unit are contained in the application, please see Volume I, Section 3, Section 4 and Volume II, Appendix A of the October 26th application respectively. In addition, hourly and annual emission rates and pollutant identification for each respective emission unit can be referenced from the application. Emissions were based on the maximum rated capacity of the plant, worst-case operating conditions, and 8760 hours per year after controls. The PCBs' annual emissions, as shown below in Table 3.1 and in Table 4.0-1 of the application, are calculated for worst-case conditions while operating at 100% load. Evaluations at 50% and 75% load were also performed.

Table 3.1 –Applicant Annual Emission Summary

POLLUTANTS	EMISSION RATE TONS PER YEAR
CARBON MONOXIDE (CO)	6,599
NITROGEN OXIDES (NO_x)	6,029
PARTICULATE MATTER (PM_{10})	1,328
SULFUR DIOXIDE (SO_2)	10,954
VOLATILE ORGANIC COMPOUNDS (VOC)	509
MERCURY (Hg)	0.21
BERYLLIUM (Be)	0.0615
FLUORIDES (AS HF)	10.34
SULFURIC ACID MIST (H_2SO_4)	326

4. REGULATORY REVIEW

This section presents a discussion on the air quality regulations applicable to this project in addition to the PSD requirements. In some cases the emission limit or technology standard based on these regulations may be superseded by the BACT requirements which are more stringent under PSD (see Section 5, Best Available Control Technology Review); however, any specific testing, monitoring, record keeping, and reporting requirements contained in these regulations will still have to be met by the source in addition to any requirements under PSD.

The following regulations will apply to the proposed plant (please see the application for a detailed description of the plant and specific processes/units within the plant):

A. New Source Performance Standards (NSPS)

The Clean Air Act of 1970 directed U.S. EPA to establish New Source Performance Standards, or NSPS, for specific industrial categories. There are three NSPS applicable to the Thoroughbred project.

New Source Performance Standards for Steam Electric Generating Units

Under the NSPS directive, U.S.EPA developed 40 CFR Part 60, Subpart Da, for all new, modified, or reconstructed steam generating units with a maximum heat input capacity greater than 250 MMBTU/hour for which construction is commenced after September 18, 1978. The proposed PCBs will be subject to Subpart Da, since the PCBs will be constructed after September 18, 1978. The emission limits being proposed for the PCBs are much lower than the applicable standard for NOx, SO_2 and PM/PM_{10} emissions in Subpart Da. Therefore the NSPS requirements will be met.

<u>New Source Performance Standards for Coal Preparation Plants</u>

Subpart Y of 40 CFR part 60, Standards of Performance for Coal Preparation Plants, incorporated by reference in regulation 401 KAR 60:005, Section 3(1), requires coal processing facilities to comply with certain particulate standards. Activities regulated by this NSPS include crushing, screening, conveying, transferring and storage of coal. Emission points are subject to an opacity limitation of 20%. Proposed BACT emission limits for coal processing activities will meet all NSPS requirements.

<u>New Source Performance Standards for Non-Metallic Mineral Processing Plants</u>

40 CFR part 60 Subpart OOO, Standards of Performance for Non-Metallic Processing Plants, incorporated by reference in regulation 401 KAR 60:670, regulates particulate emissions from crushing, screening, milling, transferring and truck unloading of Non-Metallic Minerals. Operations enclosed in buildings are allowed zero fugitive emissions. Emissions vented through a stack are limited to 7% opacity and 0.05 gr/dcm. Conveyors and transfer points are allowed 10% fugitive visible emissions, while crushing operations are allowed 15% opacity if a capture system is not used. Trucks unloading into screening operations, hoppers or crushers are exempt from the particulate matter standard. The proposed BACT emission limits for non-metallic mineral processing will meet these NSPS requirements.

<u>New Source Performance Standards for Industrial-Commercial-Institutional Steam Generating Units</u>

Under the NSPS directive, U.S.EPA developed 40 CFR Part 60, Subpart Db, for all new, modified, or reconstructed steam generating units with a maximum heat input capacity greater than 100 MMBTU/hour for which construction is commenced after June 19, 1984. The proposed Auxiliary Boiler will be subject to Subpart Db, since it will be constructed after June 19, 1984. Proposed BACT emission limits for the auxiliary boiler will ensure these NSPS requirements are met.

B. State Requirements

The State of Kentucky has developed specific new source standards in 401 KAR 59:016 for new electric utility steam generating units. 401 KAR 59:016 standards apply to each electric utility steam generating unit built after September 19, 1978, that is capable of combusting more than 250 MMBTU/hr heat input of fossil fuel. Additionally, Kentucky has developed new source standards in 401 KAR 59:015 which apply to indirect heat exchangers built after the classification dates and that are capable of a heat input capacity greater than 1 MMBTU/hr. Regulation 401 KAR 59:015 does not apply to units subject to 401 KAR 59:016. The state's emission standards parallel the Federal NSPS standards therefore, the proposed facility will also be in compliance with Kentucky emission standards if it is in compliance with NSPS standards.
Regulation 401 KAR 63:020, applies to Potentially hazardous matter or toxic substances

C. Maximum Achievable Control Technology Standards (MACT)

40 CFR 63, Subpart B, Requirements for Control Technology Determinations for Major Sources in Accordance With Clean Air Act Sections, Sections 112(g) and 112(j) ("Case by Case MACT")

Section 112(g) of the 1990 Clean Air Act Amendments (CAAA), requires certain new major sources of HAPs to implement maximum achievable control technology (MACT) standards. MACT standards are used to ensure a performance-based method for reducing toxic and HAP emissions. The control technology to be used to ensure maximum control is determined by establishing a MACT floor. The MACT floor for existing units is the average emission limitation achieved by the best performing 12% of existing sources. The floor for new sources can be no less stringent than the emission control achieved in practice by the best-controlled similar source.

Currently there are no finalized MACT standards for HAP emissions from oil and/or coal fired electric utility steam generating units. However, in a notice of regulatory finding released in December 2000, the USEPA indicated that the development of regulations under Section 112 of the Clean Air Act for HAP emissions from this industry is warranted. The USEPA further indicated that the proposed emission standards for HAP emissions from oil and/or coal fired electric utility steam generation units will be issued no later than December 2003 with promulgation of these standards no later than December 2004. Since no MACT standards have been established, the source as stated above must attain emission controls equal to or better than the best-controlled similar source.

The applicant has indicated that the control technologies being proposed at the facility will be equal to or better than any similar source. KYDAQ concurs with the applicant's determination. Based on the control technologies being used at the facility and the data provided in the US EPA documents the proposed control technology and emission limits will meet or exceed the control levels at other sources. According to the application the overall mercury removal from the facility is estimated to be greater than 80 percent with possible removals in excess of 90 percent. Similarly, HAP emissions from the facility will nearly all be removed by utilizing the WESP which is beyond any control technologies currently in use by electric generating units for HAP controls. Based on the proposed control technologies and the reductions expected, KYDAQ agrees the facility should meet or exceed the requirements for the best-controlled similar sources and therefore complies with all applicable MACT requirements.

D. Phase II Acid Rain Permits

Title IV of the Clean Air Act requires reductions in emissions of SO_2 and NO_x in an effort to reduce formation of acid rain. U.S.EPA, in promulgating regulations in 40 CFR Part 72, requires the submittal of application forms (incorporated by reference in Regulation 401 KAR 52:060) no later than two years prior to commencing operations of a regulated unit. This source is required to apply for a Phase II Acid Rain permit. Under Phase II Acid Rain requirements, filing of a Title V application for a new source subject to the Acid Rain requirements requires the source to file the Phase II application at the same time. Additionally, part 75 requires continuous emission monitoring for NOx and sulfur dioxide. Proposed emission limits for NO_x and SO_2 are much lower than Title IV Acid Rain requirements.

Therefore, Title IV requirements will be met.

E. CAM-Compliance Assurance Monitoring

The applicant has indicated that the requirements are not applicable. However, the division does not concur and has determined that regulation 40 CFR 64.2 and 64.4 are applicable requirements for the source. Therefore, the applicant shall submit a plan as required by 40 CFR 64 prior commencement of operation. Pursuant to 401 KAR 52:020 the plan shall receive public notice to ensure enforceability.

F. Additional Requirements

The owner is required to conduct a performance test within 60 days after achieving the maximum production rate at which the affected facilities will be operated but not later than 180 days after initial start-up of such facilities. Under the NSPS, indirect heat exchangers of greater than 250 MMBTU/hr heat input, firing coal derived fuels are required to be performance tested for pollutants to which the standard applies.

Subpart Da requires an initial performance test for particulates, sulfur dioxide and nitrogen oxides. 40 CFR 60 Subpart Da refers to 40 CFR 60.8 for testing requirements. The facility will perform an initial compliance test for particulates, sulfur dioxide and nitrogen oxides per Appendix A of 40 CFR 60.

The permittee will have a continuous emission monitor (CEMs) for SO_2, NO_x, and oxygen or CO_2, as well as, COMs for opacity monitoring on the PC boilers.

The permit provides the appropriate monitoring, testing, reporting, and record keeping requirements of Subpart Da.

G. PSD Requirements

As stated earlier, Regulation 401 KAR 51:017 (40 CFR 52.21), Prevention of Significant Deterioration (PSD) of air quality, applies to the proposed plant. The facility will be located in Muhlenberg County, which is currently designated as “attainment” or “unclassified” for all ambient quality standards. Total plant wide potential emissions of all criteria pollutants including fugitive emissions are listed in Table 4.1.

TABLE 4.1 – Total Plant Wide Potential Emissions

Pollutant	PTE * (tons per year)	Significant Emission Rate ** (tons per year)
Nitrogen oxides (NO_x)	6,029	40
Carbon monoxide (CO)	6,599	100
Sulfur dioxide (SO_2)	10,954	40
Particulate (PM/PM_{10}	1,328	25
Volatile organic compounds (VOC)	509	40
Fluorides (as HF)	10.34	3
Mercury (Hg)	0.21	0.01
Beryllium (Br)	0.0615	0.0004
Sulfuric Acid Mist (H_2SO_4)	326	7

* PTE - Potential to emit, emissions for PCBs calculated with 8760 hours/year operation and worst case operating conditions, and include ancillary equipment.

** Significant emission rate as given in Regulation 401 KAR 51:017, Section 22.

As seen in the preceding table, the plant will be a major source for all of the pollutants listed. The PSD review applies to every pollutant that the proposed plant will emit in significant quantities, i.e., in amounts that will exceed the respective significant net emission rate. In addition, the plant will be subject to PSD review for sulfuric acid mist, mercury, beryllium, fluorides as HF, VOCs, nitrogen oxides, carbon monoxide, sulfur dioxide, and PM/PM_{10}. For each of these pollutants, the applicant has performed a best available control technology (BACT) demonstration and an ambient air quality analysis. Each of these components of the PSD review process have been discussed in detail in the following sections.

5. BEST AVAILABLE CONTROL TECHNOLOGY REVIEW

Pursuant to Regulation 401 KAR 51:017, Section 9(1) and (2), a major stationary source subject to a PSD review shall meet the following requirements:

(a) The proposed source shall apply the best available control technology (BACT) for each pollutant that it will have the potential to emit in significant amounts.

(b) The proposed source shall meet each applicable emissions limitation under Title 401, KAR 50 to 65, and each applicable emission standard and standard of performance under 40 CFR 60, 61, and 63.

The proposed source will be a major source resulting in emissions of sulfuric acid mist, beryllium, mercury, fluorides as HF, VOCs, nitrogen oxides, carbon monoxide, sulfur dioxide, and PM/PM_{10} that exceed the corresponding PSD net significant emission amounts. Therefore, each of these pollutants was subjected to a BACT review.

Thoroughbred Generating Station has presented, in the permit application, a study of the best available control technology for each pollutant and each emissions unit at the proposed source. The Division has reviewed the proposed control technologies in conjunction with information available in the U.S. EPA's RACT/BACT/LAER Clearinghouse (RBLC) database and other similar sources. A summary of the control technology determined to be the best available control technology for each pollutant and each emissions unit is presented in Table 5.1.

TABLE 5.1 – BACT Summary for PC Boilers

EIS No.	Emissions Unit/Process	Pollutant	Best Available Control Technology	Emission Standard
01, 02	Pulverized Coal Fired Utility Boilers Operation limitation: None The emission control equipment and emission limits proposed will ensure compliance with all future MACT requirements.	NO_X	PC Design and Operation; LOW NO_x Burners and SCR (Beyond BACT) Visibility Limit	0.1 lb/MMBTU 0.09 lb/MMBTU
		CO	Good combustion Control and operation	0.1 lb/MM BTU
		SO_2	PC Design and operation, Wet FGD (Beyond BACT) Visibility Limit	0.294 lb/MM BTU 0.167 lb/MMBTU
		PM/PM_{10}	Baghouse	0.018 lb/MM BTU
		VOCs	PC Design and operation	0.0072 lb/MM BTU
		Beryllium Mercury	Baghouse, WESP	$9.44e^{-7}$ lb/MM BTU $3.21e^{-6}$ lb/MM BTU
		Fluorides as HF	Baghouse, WET FGD Scrubbing and WESP	$1.59e^{-4}$ lb/MM BTU
		Sulfuric Acid Mist	PC Design & Operation, WFGD, and WESP (Beyond BACT) Visibility Limit	0.306 lb/MM BTU 0.00497 lb/MMBTU

The permittee submitted a top-down Best Available Control Technology (BACT) analysis following the U.S. EPA guidance, "New Source Review Workshop Manual" (U.S. EPA, October 1990). The key steps involved with the top-down BACT process are as follows:

1. Identify all control technologies
2. Eliminate technically infeasible options
3. Rank remaining control technologies by control effectiveness
4. Evaluate most effective controls considering economic, environmental, and energy impacts, and document results

5. Select BACT.

A. BACT for Pulverized Coal (PCB) Fired Boilers

The following section summarizes the BACT determinations for criteria pollutants from the proposed facility. Using the top-down approach, the applicant selected various technologies for analysis of technical and practical feasibility, and then applied economic cost-effectiveness analyses where the top ranked technology was not selected. Table 4.0-4 from the application is provided below as Table 5.2, and lists various technologies considered by the applicant in its BACT evaluation.

TABLE 5.2 - Ranking of Control Technologies by Effectiveness

Pollutant	Control Technology	Potential Add-on Control Efficiency (%)
PM_{10}*	Baghouse	99.9‡
	Electrostatic Precipitator (ESP)	99.9‡
	Wet Scrubber	90.0‡
	Cyclone	90.0‡
SO_2/ Acid Gases	Wet Scrubbers/ Wet ESP	90+
	Dry Scrubber	90+
	Alternative Emerging Technologies	90+
NOx	Selective Catalytic Reduction (SCR)	60-90
	Flue Gas Recirculation (FGR)	40-85
	Selective Non-Catalytic Reduction (SNCR)	40-70**
	Non-Selective Non-Catalytic Reduction (NSNCR)	20-50**
	Low NO_x Burner, Startup Operations	15-30**
	Proper Boiler Design and Operation	
CO	Thermal Oxidation	95‡
	Catalytic Incineration	90-95‡
	Excess Air	75‡
	Proper Boiler Design and Operation	
VOCs	Proper Boiler Design and Operation	
Beryllium	Baghouse/WESP	
Mercury	Scrubbing and Baghouse	

‡Cooper, C.D. and F.C. Alley, *AIR POLLUTION CONTROL: A Design Approach*, Waveland Press, 1986.

**Alternative Control Technologies Document NOx Emissions from Utility Boilers, US EPA-453/R-94-023, 1994

NOx

Control methods for NO_x can be divided into two types of control technologies: post-combustion controls and combustion controls. Post-combustion NO_x control removes NO_x from the exhaust gases of the boiler. Combustion NO_x control reduces the amount of NO_x that is generated during combustion.

The applicant is proposing low NO_x burners to address the combustion generating part of the analysis. Low NO_x burners have been accepted as BACT for combustion control technology consistently for similar sources in the past. Post-combustion NO_x control techniques were also considered to further control NOx.

The applicant has elected to utilize selective catalytic reduction (SCR) in conjunction with low NO_X burners to reduce NOx emissions to levels below those required by recent EPA proposed regulations regarding ozone, and to meet the most stringent NO_x emission limitation in the RBLC.

SCR and low NO_X burners are supported by recent determinations in the RBLC database for PC boilers and other similar applications currently being reviewed in other regulatory agencies. In consideration of RBLC, the applicant is proposing that the NO_x emission limitation be set at 0.10 lb/MM BTU heat input 30 day rolling average. Additionally, the applicant has proposed a more restrictive limit of 0.09 lb/MMBTU that goes beyond the BACT limits of this and other similar sources to address visibility concerns expressed by the National Parks Service at Mammoth Cave.

CO

Carbon monoxide is formed as a result of incomplete combustion of fuel. For carbon monoxide control, the permittee evaluated the available control technologies, which are: high temperature oxidation, catalytic oxidation and the front-end technique of good combustion control. The most stringent CO control level available for PCBs would be achieved with the use of a high temperature oxidation system added at the exhaust of the baghouses, which can remove approximately 95 percent of CO in the flue gas. Proper boiler design and operation is BACT for CO emissions. The CO emissions shall not exceed 0.10 lbs/MMBTU from each unit based on a thirty (30) day rolling average

The Division has reviewed the EPA BACT/RACT/LAER Clearinghouse for PC boilers. In no cases since early 1990 are there any documented permits that have specified thermal oxidation as BACT. The overwhelming majority of determinations specify good combustion practice; good combustion control and operation; proper design; and in some cases no controls.

There are environmental impacts associated with the use of a catalytic oxidation system on a PC boiler due to the oxidation of SO_2 to SO_3. The SO_3 can react with water or ambient ammonia in the exhaust and form sulfuric acid or ammonia sulfates. There is also generation of hazardous waste from the spent catalyst.

The economic analyses provided for the CO thermal and catalytic oxidation options provided by the applicant are shown in Section 4 of the permit application. The Division has reviewed and accepted cost data provided by the applicant. This information indicates the total capital investment costs, annualized costs, and overall cost effectiveness for CO emissions calculated by the permittee. Table 5.3 summarizes the results of the overall cost effectiveness of CO removal for each PCB:

Table 5.3 – CO Removal Cost Effectiveness

PCB Model	Overall Cost Effectiveness ($/ton)
Thermal Oxidation	13,899
Catalytic Oxidation	9,795

The Division has determined that the overall cost effectiveness numbers indicate that the application of high temperature or catalytic oxidation for CO is not economically feasible.

Considering the potential environmental and energy impacts associated with extended startup times and the economic impact of oxidation catalyst technology, the Division agrees with the permittee's elimination of these control technologies.

A properly designed and operated PC boiler effectively functions as a thermal oxidizer. CO formation is minimized when the boiler temperature and excess oxygen availability is adequate for complete combustion. Minimization of the CO emitted is in the economical best interest of the boiler operator as CO represents unutilized energy exiting the process. No incremental costs are associated with this option. In Section 4 of the application, the applicant, in discussing NO_x control, noted that CO emission rates are identified as a potential factor, which affects NO_x emissions inverse proportionally (i.e., lower CO tends to produce higher NO_x). KYDAQ therefore agrees that proper boiler design and operation is BACT for CO emissions.

SO_2

The applicant considered several potential Flue Gas Desulfurization systems and acid gas control technologies for the proposed project. These technologies are listed in Table 4.2-1 *SO_2 Emission Control Options* of the revised application. All of the control technologies are capable of removal efficiencies in excess of 90%, however not all technologies are capable of effectively reducing the amount of acid gases emitted. The original BACT submittal contained a list of possible control technologies with a SO_2 BACT emission limit of 0.294 lbs/MMBTU and a H_2SO_4 mist emission limit of 0.306 lbs/MMBTU based on a 30 day rolling average. However due to concerns regarding possible visibility changes at Mammoth Cave National Park the applicant was requested to revaluate possible control technologies.

The applicant performed additional analysis of available technologies, which would result in further reductions of SO_2 and acid gas emissions. It was determined that a combination of two technologies would reduce emission levels to ensure minimal change in visibility at the national park. The technologies included wet limestone scrubbing, which will effectively control SO_2 and other pollutant emissions, and wet electrostatic precipitation, which will reduce HAP and acid gas emissions including HF and H_2SO_4.

Based on the above discussion; the BACT evaluation detailed in Section 4 of the application; and in consideration of the coal quality, the Division has determined that an SO_2 emission limit of 0.294 lb/MMBTU based on a 30-day rolling average and an H_2SO_4 emission limit of 0.306 lbs/MMBTU based on a 30-day rolling average is BACT. However, in light of the concerns with possible visibility changes at Mammoth Cave National Park the Division has determined that even more stringent limits must be imposed to maintain visibility at the park. Therefore, the permit contains an SO_2 emission limit of 0.167 lbs/MMBTU and an H_2SO_4 mist emission limit of 0.00497 lbs/MMBTU based on a 30-day average to address those visibility concerns as beyond BACT control technology proposed by the applicant.

PM/PM$_{10}$

Particulate from the PC boilers are primarily the result of ash content and other contaminants in the fuel. There are several control technologies for removing particulates from a gas stream but a baghouse and electrostatic precipitator (ESP) have the highest control efficiency of any of the particulate matter control options, and therefore, according to the “top-down” approach, must be considered first.

Baghouse:

A baghouse removes pollutants and condensed metals (beryllium, lead and mercury) from the exhaust gas by drawing the dust-laden air and condensables through a bank of filter tubes suspended in a housing. A filter “cake”, composed of the removed particulate, builds up on the “dirty” side of the bag. Periodically, the cake is removed through physical mechanisms (e.g., a blast of compressed air from the “clean” side of the bag, shaking the bags, etc.), which cause the cake to fall. The dust is then collected in a hopper and eventually removed.

Electrostatic Precipitator (ESP):

Electrostatic Precipitators remove aerosol and particulate matter from exhaust gas streams by means of electrostatic attraction. Particles in the gas stream are negatively charged by discharge electrodes located in the ESP. Once the particles are negatively charged they migrate toward the grounded collection plates in the ESP, which have been positively charged. The particulate continues to accumulate on the collection plate until it is removed. The particulate is removed from the plates either by rapping or spraying. It is then collected in a hopper for disposal. ESPs have the ability to handle large gas streams and high particulate loading with very few complications and restrictions, as opposed to baghouses. While a baghouse and ESP are capable of similar removal efficiencies the ESP has a much broader operating range and can be utilized at higher temperature and pressure conditions, as well as, with wet or dry gas streams.

Wet Electrostatic Precipitator (WESP):

Wet electrostatic precipitators operate in much the same way as a dry or standard ESP; charging, collecting and finally cleaning. It is the cleaning step that is different. Cleaning is performed by washing the collection surfaces with water, in place of the usual mechanical means such as rapping of the collection plates. The delivery of the liquid or water can be made by a series of spray nozzles located in the control device or by condensing moisture from the flue gas on the collection surfaces. WESPs are able to control a larger variety of pollutants than an ESP can alone. WESPs are significantly better at controlling acid droplets and SO_3 gases. This has been well supported by installations at acid production plants and other industrial sources that have highly acidic exhaust streams. Higher levels of SO_3 in the exhaust gas actually greatly improve the collection efficiency of the WESP by reducing the electrical dust resistance. WESPs are also very effective in reducing re-entrainment of particles due to the constant cleaning of the collection surfaces by liquid. Additionally, WESPs can operate under much higher electrical power than ESPs, therefore enabling much greater reductions in sub micron particulates.

According to information supplied in the application when used in conjunction with wet flue gas desulfurization, WESPs are very effective in reducing SO_3, metals and other sub micron particulates. WESPs are discussed further in the section on SO_2 and acid gas controls.

The applicant has selected a baghouse as BACT for PM/PM_{10} , mercury, beryllium, and other metals for the PC boilers. The current market information and other sources in the RBLC and the control technology being proposed for the PC Boilers PM/PM_{10} technology in conjunction with a PM/PM_{10} BACT, sets emission limits of 0.018 lb/MMBTU based on a three (3) hour average.

Control of Non-Criteria Pollutants

The combustion of coal may release trace amounts of a number of non-criteria pollutants. Three of the PSD regulated pollutants (mercury, beryllium, and sulfuric acid mist) require BACT analysis as defined by EPA. For all of these pollutants the RBLC database and other recently issued permits have indicated best available control technology is a baghouse control, FGD and proper boiler design and operation.

The BACT for metals, acid gases and other non-criteria pollutants is a baghouse in combination with a flue gas desulfurization unit and proper design and operation of the boilers and system. However, due to the concerns expressed with regards to the possible visibility change at Mammoth Cave National Park, beyond BACT technology has been requested by the regulators and agreed to by the applicant. The applicant has agreed to install, in addition to the baghouse and WFGD, a wet electrostatic precipitator, which will further reduce the emissions of non-criteria pollutants such as acid gases (see prior section related to acid gases).

B. PM/PM_{10}-Material Handling

In the case of limestone, coal, and ash handling equipment, bin vent fabric filters and baghouses constitute BACT. This includes the emission from the silos, mills, crushers, and other devices. With respect to the conveyors and transfers, enclosure and coverings in addition to filter controls is deemed to be BACT for particulates. These types of controls are consistent with similar types of sources and equipment found in the RBLC and other recently issued permits.

C. PM/PM_{10}-Cooling Towers

Particulate emissions from the cooling towers in the form of drift shall be controlled by Drift Eliminators. The applicant has proposed 0.002% drift eliminators to control the emission of PM/PM_{10} from the cooling towers. Based on the information provided and the design of the system the Division agrees that the proposed 0.002% drift eliminators constitute BACT for particulate control from the cooling towers.

D. Auxiliary Boiler

The auxiliary boiler will be a 300 MMBTU/hr unit. The boiler will minimize emissions by utilizing low NO_x burners and firing low sulfur diesel fuel. The boiler will be used for the startup of the first boiler and operate on a limited basis. The Division agrees that the proposed design and operation of the boiler must be included in the BACT analysis and hour of operation for the boiler capped at 4000 hours per year or less.

E. Fire Water Pumps

The applicant has proposed to install two 265hp fire pumps for emergencies. The Division agrees that the use of low sulfur diesel fuel and limiting operation of the pumps to 500 hours or less per year constitutes BACT for fire pumps.

F. Emergency Diesel Generator

Similar to the firewater pumps the applicant has proposed to install a 2.25 MW generator for emergency use. The Division agrees that the use of low sulfur diesel fuel and limiting the operation of the generator to 500 hours or less per year constitutes BACT.

6. AIR QUALITY IMPACT ANALYSIS

Pursuant to Regulation 401 KAR 51:017, Section 12, an application for a PSD permit shall contain an analysis of ambient air quality impacts, in the area that the proposed facility will affect, for each pollutant that it will have the potential to emit in significant amounts as defined in Section 22 of the same regulation. The purpose of this analysis shall be to demonstrate that allowable emissions from the proposed source will not cause or contribute to air pollution in violation of:

(1) A national ambient air quality standard in an air quality control region; or
(2) An applicable maximum allowable increase over the baseline concentration in an area.

The proposed facility will have potential emissions in excess of the significant net emission rates for nitrogen oxides, PM/PM_{10}, sulfur dioxide, VOCs, fluorides as HF, beryllium, mercury, sulfuric acid mist and carbon monoxide.

A. Modeling Methodology

The application for the proposed source contains ISCST3 air dispersion modeling analysis for criteria and non-criteria pollutants (nitrogen oxides, PM/PM_{10}, sulfur dioxide, fluorides as HF, beryllium, mercury, sulfuric acid mist and carbon monoxide) to determine the maximum ambient concentrations attributable to the proposed plant for each of these pollutants for comparison with:

1. The significant impact levels (SIL) found in 40 CFR 51.165 (b)(2).
2. The Significant Air Quality Impact levels (SAI) found in Regulation 401 KAR 51:017, Section 24.
3. The PSD Class I and Class II increments found in Regulation 401 KAR 51:017, Section 23.
4. The National Ambient Air Quality Standards (NAAQS) found in Regulation 401 KAR 53:010, Ambient air quality standards.

All applicable ambient air quality concentration values are presented in Table 6.1. Based on U.S. EPA procedures, if the maximum predicted impacts for any pollutant are found to be below the SILs, then it is assumed that the proposed facility cannot cause or contribute to a violation of the PSD pollutant increments or the national ambient air quality standards (NAAQS). Therefore, no further modeling would be required for such a pollutant. The applicant may also be exempted from the ambient monitoring data requirements if the impacts are below the significant monitoring concentrations or SAI. The SAI levels determine if the applicant will be required to perform pre-construction monitoring. If the modeled impacts equal or exceed the SAI levels, pre-construction monitoring may be required. As shown in the application, the SAI levels were exceeded for the 3-hour; 24-hour; and annual modeled impacts. However, if existing air quality data is available that is representative of the air quality area in question an exemption may be granted. The applicant requested that data from the TVA Paradise monitors be accepted as representative of the area. The Division determined the location of the monitor; quality of the data; and the data's correctness all met the requirements listed in the NSR guidance manual and issued a letter of approval on September 22, 2000. Therefore, the applicant is exempted from the pre-construction ambient monitoring data requirements for sulfur dioxide.

TABLE 6.1 – Ambient Air Quality Concentration Values

Pollutant	**Averaging Period**	**SIL** ($\mu g/m^3$)	**SAI** ($\mu g/m^3$)	**PSD Class II Increments** ($\mu g/m^3$)	**NAAQS** ($\mu g/m^3$)
NO_x	Annual	1	14	25	100
PM_{10}	Annual 24-hour	1 5	NA 10	17 30	50 150
SO_2	Annual 24-hour 3-hour	1 5 25	NA 13 NA	20 91 512	80 365 1300
CO	8-hour 1-hour	500 2000	575 NA	NA NA	10000 40000

The permittee used the Industrial Source Complex Short Term model (ISCST3, Version *00101*, EPA,

1999) in the analysis. The ISCST3 model fulfills the requirements of Supplement C of the Guideline on Air Quality Models (Appendix W to 40 CFR 51). All of the parameters used in the modeling analysis for each pollutant appear satisfactory and consistent with the prescribed usage for this model. Per EPA guidance, the ISCST3 model was run with the regulatory default option in a sequential hourly mode using five years of meteorological data. Surface data and concurrent upper air data used were based on weather observations taken at the National Weather Service (NWS) station at the Paducah, Kentucky and Nashville, Tennessee respectively from 1985 to 1987 and 1990 to 1991.

With respect to the Class I modeling the applicant used the CALPUFF model with refined inputs to better predict possible impacts for the particular region in question. Detailed documentation of the modeling inputs and the techniques used are provided in Volume II, Appendix E of the application.

In consultation with the Federal Land Manager (FLM) and the National Park Service (NPS) the permittee will consider two more years of modeling, using 1992 and 1996 MM5 data with the concurrent surface, upper air, and precipitation data.

B. Modeling results - Class II Area Impacts

The proposed facility will be located in Muhlenberg County, a Class II area. The applicant modeled the impact of the emissions from the proposed facilities on the ambient air quality and the results of the modeled impacts on the Class II area have been presented in Table 6.2.

The modeling results show that the maximum impacts from the proposed facility for NO_x and CO are less than the EPA prescribed significant ambient impact levels (SIL) and no further analysis are required. However, the 24-hr and annual PM/PM_{10} impacts and the 3-hour; 24-hour; and annual sulfur dioxide impacts all exceeded the prescribed SILs. Therefore, refined modeling was performed for PM/PM_{10} and sulfur dioxide, by including all existing major sources within 100 km of the significant impact area for particulate and sulfur dioxide emissions. The refined modeling required for NAAQs and PSD Increment analysis is presented in Table 6.3. Modeling concentrations all were significantly lower than the NAAQS and PSD Increments allowed. Detailed descriptions of the modeling inputs and results are in Volume I, Section 6 and 7 of the application.

TABLE 6.2 – Applicants Modeled Predicted Impacts

Pollutant	Averaging Period	SIL ($\mu g/m^3$)	SAI ($\mu g/m^3$)	Max Impact of Emission ($\mu g/m^3$)	SIA (km)	Preconstruction Monitoring Required
NO_2	Annual	1	14	0.697		No
PM_{10}	Annual 24-hour	1 5	NA 10	1.69 8.86	2.5	NA No
SO_2	Annual 24-hour 3-hour	1 5 25	NA 13 NA	1.57 27.76 112.40	50	NA Exempt NA
CO	8-hour 1-hour	500 2000	575 NA	39.12 168.94		No NA
Beryllium	24-hour	NA	0.001	0.00088		No
Mercury	241-hour	NA	0.25	0.00285		No

TABLE 6.3 – Refined Modeling Results

Pollutant	Averaging Period	Class II PSD Increment ($\mu g/m^3$)	Applicant's Class II Increment Consumption[3] ($\mu g/m^3$)	NAAQs ($\mu g/m^3$)	Source Plus Other Sources Modeling Results ($\mu g/m^3$)	Source Plus Background Modeling Results ($\mu g/m^3$)
PM_{10}	Annual[1] 24-hour	17 30	1.69 8.86	50 150	1.97 13.17	27.69 75.17
SO_2	Annual[1] 24-hour 3-hour	20 91 512	1.57 27.76 112.40	80 365 1300	28.67 186.76 779.37	17.29 143.33 504.55
NO_x	Annual[2]	25	0.697	100	NA	NA

1. Annual geometric mean
2. Annual arithmetic mean
3. Increment consumption based on high-second-high

C. Modeling Results - Class I Area Impacts

The nearest federally designated Class I area to the project site is Mammoth Cave National Park. The nearest park boundary is approximately 74 km to the East-Southeast of the proposed facility and was analyzed by the applicant using the CALPUFF model at the request of the FLM and the Division. Results of this modeling are presented in Volume I, Section 8 of the application. Table 6.4 lists the modeled increment consumption for the proposed source and illustrates no Class I increments will be exceeded. Additional information regarding the Class I modeling is presented in Volume I, Section 8 and Volume II, Appendix E of the application.

Table 6.4 – Modeled Class I increment Consumption

Pollutant	**Averaging Period**	**Class I Increment** ($\mu g/m^3$)	**Source Class I Increment Consumption** ($\mu g/m^3$)
NO_x	Annual	2.5	0.018
PM_{10}	Annual 24-hour	4 8	0.016 0.137
SO_2	Annual 24-hour 3-hour	2 25 5	0.142 1.16 4.37
CO	8-hour 1-hour	500 2000	10000 40000

Although there are no predicted exceedances of Class I increments at the park the FLM has expressed concerns regarding the possible change in visibility that may result from the project emissions. While there are a few days that have been predicted to slightly exceed the 5% visibility change and zero days exceeding a 10% change, set as screening values for Class I areas, regulation 401 KAR 51:017 does allow for a case-by-case determination with regards to potential impacts and what is acceptable. After carefully reviewing the application and existing similar sources the Division agrees that the minimal number of days that could potentially exceed the 5% change in visibility is far outweighed by the control technology and the emission limits being proposed.

7. ADDITIONAL IMPACTS ANALYSIS

A. Growth Analysis

The proposed project, as reported in the application, will employ approximately 1000 personnel during the construction phase. The project will employ approximately 500 people on a permanent basis. It is a goal of the project to hire from the local community where possible. There should be no substantial increase in community infrastructure, such as additional school enrollments. The proposed project is also not expected to result in an increase in secondary emissions associated with non-project related activities. Thus, in accordance with PSD guidelines, the analysis of ambient air quality impacts need consider only emissions from the facility and its ancillary devices.

B. Soils and Vegetation Impacts Analysis

The project lies in an area of mainly post mining use. No significant off-site impacts are expected from the proposed action. Therefore, the potential for adverse impacts to either soils or vegetation is minimal. It is concluded that no adverse impacts will occur to sensitive vegetation, crops or soil systems as a result of operation of the proposed project.

C. Visibility Impairment Analysis

As discussed previously in Section 6(a) the visibility at Mammoth Cave National Park was reviewed using the visibility function in the CALPUFF model. The projected change in visibility associated with the operation of the proposed facility has been determined to be minimal as a result of the multiple control technologies that will be utilized. Additionally, the Commonwealth of Kentucky has not determined any Class II areas in the vicinity of the proposed plant to have visual sensitive criteria established. Therefore, no significant change in visibility is expected from the facility.

8. CONCLUSION AND RECOMMENDATION

In conclusion, considering the information presented in the application, the Division has made a preliminary determination that the proposed source meets all applicable requirements:

1. All the emissions units are expected to meet the requirements of BACT for each significant pollutant. Additionally, each applicable emission limitation under 401 KAR Chapters 50 to 65 and each applicable emission standard and standard of performance under 40 CFR 60, 61, 63 and 64 will also be met prior to proposed/final permit.
2. Ambient air quality impacts on Class II areas are expected to be below the significant impact levels. No adverse impact is expected on any Class I area.
3. Impacts on soil, vegetation, and visibility have been predicted to be minimal.

A draft permit to construct and operate a nominal 1500 MWe pulverized coal fired electric generating facility in Muhlenberg County near Graham, Kentucky containing conditions which ensure compliance with all the applicable requirements listed above has been prepared by the Division and issued for public notice and comment. The Division recommends the issuance of the final permit upon satisfaction of the public comments. A copy of this preliminary determination will be made available for public review at the following locations:

1. Affected public at the Muhlenberg County Clerk's office.
2. Division for Air Quality, 803 Schenkel Lane, Frankfort.
3. Division for Air Quality, Owensboro Regional Office, 3032 Alvey Park Drive West, Suite 700, Owensboro, KY 42303.